

## THE USAGE OF DIGITAL TECHNOLOGY AND ITS EFFECT ON ADOLESCENT SLEEP PATTERNS: AN EVIDENCE BASED REVIEW

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### ABSTRACT

**Background:** Electronic use before bedtime causes sleep disturbances in adolescents, and has also been shown to increase physiological, emotional or mental arousal. This evidence-based review aimed to explore the usage of technology among adolescents in bed and its negative impact on health. **Methods:** Pubmed / Medline and google scholar data bases were searched by the author to identify studies published from 2008 – 2021 covering adolescents using media at bedtime using key search terms such as insufficient sleep in adolescents, abnormal sleep patterns and unhealthy sleep habits. **Results:** The findings from the related articles show that the usage of technology among adolescents significantly affects the sleep quality and quantity. Insufficient sleep in adolescents has been linked to negative physiological consequences, including an increased risk of obesity, metabolic dysfunction, psychological and behavioral consequences such as an increased risk of anxiety, depression, mood disturbances, suicidal ideation, drug and alcohol use. **Conclusion:** The results of this review recommended the urgent need for health care members, organizations, policy makers, teachers and parents to implement measures that are made mandatory to reduce and prevent health issues related to sleep disturbances among adolescents.

**Keywords:** sleep patterns, adolescents, circadian rhythm, homeostatic process, sleep habits.

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## INTRODUCTION

The United Nation defined adolescent as a person aged between 10 – 19 years. As per April 2016 UNICEF data of adolescent demographics, there are around 1.2 billion adolescents who make up 16% of the world's total population. [1] South Asia is a home to 340 million's of them, which is greater than any other region in the world and of these, 243 million live in India alone. [2] Sleep helps to fuel your brain and body. Teenagers need more sleep, because their bodies and minds are growing quickly. Scientific research shows that many teens do not get enough sleep. To be at your best, you need between 8 – 10 hours of sleep every day. Inadequate sleep quality and quantity is a public health concern, with an array of detrimental health outcomes. Portable technological devices have become a ubiquitous part of adolescent lives, and may affect their sleep duration and quality. According to the National Sleep Foundation, the recommended sleep duration for adolescents is around 9 hours per day, for optimal health and development. The National Sleep Foundation and Swedish Researchers discovered a link between heavy cell phone usage, and increased sleep disorders in both men and women.[3]

## SEARCH STRATEGY:

The author browsed pub med /medline and google scholar data bases to identify studies published from 2008 – 2021 covering adolescent's sleep and usage of digital technology. An initial assessment of articles, titles, and abstracts were done for eligibility. Full text articles were also screened if needed. Later, a reassessment of the included articles were done; followed by extraction of relevant data.

The following central questions were addressed in this review?

1. Why is adequate sleep important for teenagers?
2. What is the prevalence of sleep disturbances among teenagers using digital technology?
3. What is the rate of sleep deprivation in terms of quality and quantity in adolescents?
4. What are the consequences of health due to lack of sleep?
5. What are the study results and recommendations by the author of the researches?

## INCLUSION AND EXCLUSION CRITERIA:

From the identified related articles, the inclusion and exclusion criteria were applied. Articles published only in English between 2008 – 2021 were screened and included. Studies focusing on impact of electronic media on sleep in adolescents were included. The inclusion criteria included the age of adolescents up to 20 years. Articles that were irrelevant to the scope of the review were excluded. Inaccessible relevant full-text articles were also excluded. Articles related to adult sleep patterns were excluded. This resulted in articles being included for this review from countries like India, US, China, Norway, UK and Australia.

## THE IMPORTANCE OF SLEEP

Teenagers would require more sleep than an adult. For most teens 8 – 10 hours a night is necessary to feel rested the next day. Sleep allows your body to rest, and your brain to process the days information. Your sleep cycles are controlled by hormones that your brain releases to make you feel either sleepy at night time or awake during night time. Being physically active throughout the day, especially in natural light, allows your body to produce melatonin, the hormone that will make you sleepy at night time. Artificial light exposure between dusk and the time we go to bed at night suppresses the release of the sleep - promoting hormone melatonin, enhances alertness and shifts circadian rhythm to a later hour – making it more difficult to sleep.[4]

## What is a Circadian Rhythm? How do circadian rhythms work, and how do they affect sleep?

Circadian rhythms are driven by your body's internal master clock—it controls things like your sleep/wake cycle, eating habits and digestion, and your body temperature. Usually it is synchronized with the day-night cycle This biological process helps produce the hormone melatonin in the evening, influencing you to feel sleepy, and slows that production in the morning when you're exposed to light, which allows you to wake up and be alert. [5]

## PREVALENCE OF SLEEP DISTURBANCES AMONG TEENS

The youth behaviour risk survey found that 72.7 % of students reported an average of less than 8 hours sleep on school nights. This is similar to the National Sleep Foundation poll which reported that 62% of students get less than 8 hours of sleep on week nights. [ 6]

Data from the US Population based studies shows that 50 – 90% school aged children and adolescents do not get as much sleep as they need. Screen based devices are present in the bedroom of 75% of children and 60 % of adolescents report viewing or interacting with screens in the hour before bedtime. In a recent systematic reviewing of 67 studies of screen time and media use in school age youth teenagers from (1999 – 2014) 90% found that screen time was adversely associated with sleep health, primarily via delay bedtimes and reduced sleep duration. [7]

Moulin & Chung conducted a study in 2017 in the US among high school students and college students using a secure online survey tool. Electronic habits, internet and social networking usage, sleep and rise times, daily sleepiness and perceptions were examined. Majority owned a cell phone 84%, many high school students slept with their phones or tablets in bed 72%. College students who slept with their cell phones, tablets or laptops rose

to 86%. Over half of these students continued to access and use their devices in bed for significant amount of time prior to sleeping. Many of these even awakened after falling asleep to access and respond to electronic messages. The Research indicated that unhealthy sleep habits may be creating a generation of sleep deprived individuals, who may not be functioning at their optimum capacity. The recommendations to avoid light and screen time before bed is supported by numerous epidemiological studies that link screen-based activities to sleep disruption. [8]

A study conducted in India on Sleep patterns, hygiene and daytime sleepiness among adolescent school – goers in Tamil Nadu. The results of the study are as follows - Over 64% of adolescents sleep <8 hours at night with 5.6% sleeping <6 hours. About 48% of adolescents suffered from prolonged sleep-onset latency and about 43% had interrupted sleep. Over 64% of adolescents watched television (TV) in bed and >23% reported use of mobile phone in bed. About 64% of adolescents had at least one form of poor sleep hygiene behaviour. And also found that a large proportion of them had abnormal sleep patterns and poorer sleep hygiene behaviours.[9]

In India a cross-sectional, observational and Questionnaire based study was performed over BSc Nursing Students of University College of Nursing, on smart phone addiction and its effect on Quality of sleep. Out of 91 students, 46 students were found to be not addicted to smart phones, 17.85 % were good sleepers, while 82.42% came to be poor sleepers. Significant associations was found between age and smart phones addiction ( $p=0.000031$ ) and between daily calls and sleep Quality. ( $p = 0.025333$ ) [10]

March 2019 A Large cohort of 6616 adolescents from 39 schools in and around London, United Kingdom participated in the study. This study investigated the relationship between night-time screen-based media device both in lit room and dark rooms, and sleep outcomes and health-related Quality of life. Results: 71.5 % of adolescents reported using at least one screen – based media devices at night time. 32.2.% use mobile phones at night time in darkness. Night time mobile and television use was associated with higher odds and insufficient sleep on weekdays. Adolescents who used mobile phones in room with light were likely to have insufficient sleep on weekends compared to non-users.[11]

#### IMPACT OF TECHNOLOGY ON THE QUALITY AND QUANTITY OF SLEEP

Adolescents require approximately 8 – 10 hours of sleep per night, but many studies suggest that they obtain much less sleep. The decline in adolescent sleep quality and quantity is multifactorial, and is influenced by biological, environmental, societal, and behavioral factors.

Adolescent sleep quantity is also greatly influenced by biological processes. The two process model of sleep regulation describes sleep propensity (the likelihood of falling asleep) at the interaction between a homeostatic process (sleep need) and a circadian process (sleep – wake rhythm or “biological clock”). The homeostatic process increases sleep propensity while awake, and decreases it during sleep; while the circadian process is independent of sleep/wake state. The intersection between homeostatic and circadian processes determines wake – time.[12]

In 2012 in Norway A large Cross – Sectional population – based survey was conducted on Sleep and use of electronic devices in adolescence. 9846 adolescents from three age Cohorts aged 16 – 19 were selected. The main independent variables were type and frequency of electronic devices at bedtime and hours of screen-time during leisure time. Results analyzed shows that adolescents spent a large amount of time during the day and bedtime using electronic devices, with an increased risk of short sleep duration, long sleep onset latency and increased sleep deficiency.[13]

A study by Olson and Colleagues in 2014 explored whether night time cell phone use had an impact on **sleep quality** of adolescents 12 to 20 years of age. The study found that 62% of patients took their phones to bed with them, 37% texted after “lights out,” and 1 out of 12 adolescents were woken by a text in the middle of the night at least 2 or more times each week. Taken together, these studies have established a foundation of **declining sleep quality and quantity** in adolescents that partake in texting at bedtime or even after “lights out.”[14]

A Systematic review of 36 research studies investigating technology use in children proposed mechanisms by which electronic use before bedtime could cause sleep disturbance. (**Sleep quality**) The authors suggested that electronic use might displace sleep, since there is no fixed start or end time to electronic use. Second, media use before bed has been shown to increase physiological, emotional, or mental arousal. This has been established in video game and cell phone studies. Third, light emissions of screens from electronic media may be affecting sleep. [15]

A Study conducted in Australia 2014 on Adolescent sleep patterns and technology use. Over 70 % adolescents reported 2 or more devices in the bedroom at night. Almost every night computer use was associated with short weekday sleep duration, and almost every night cell phone use was associated with wake-lag. Use of computers, cell phones, and televisions, at higher doses was associated with sleep/awake schedules and wake-lag, potentially impairing health and educational outcomes.[16]

**HEALTH CONSEQUENCES OF SLEEP DEPRIVATION**

There is a strong link between sleep quality and physical health. The main physical health consequences of adolescent sleep loss refer to metabolic dysfunction and cardiovascular morbidity [17]

The average sleep needed for an adolescent to maintain proper health is 8 – 10 hours per night. This duration applies to a total sleep over a 24 – hour span. This recommendation is based on the American Academy of sleep Medicine expert panels, which reviewed studies on general health, cardiovascular health, metabolism, mental health, and longevity as they relate to sleep duration.[18]

**RECOMMENDATIONS FOR GOOD SLEEP HYGIENE**

A comparative study of screen time, sleep duration and behavioral disturbances in urban and rural high school children was conducted in India. This was a cross-sectional community-based study involving sixty urban and sixty rural high school students in Karnataka in India. Television was prevalent 95% urban and 76% rural students, and cell phones in 70% urban and 51.6 % rural students almost every night. The total screen duration in the urban group was nearly double that of the rural group. They observed a significant positive correlation of total screen duration with weekday sleep duration and weekend catch-up sleep. Adolescents in both groups had sleep durations considered insufficient for age. [19]

Getting enough sleep is important for maintaining cardiovascular health. A growing number of studies have demonstrated that a short sleep duration, increases the risk of cardiovascular disease.[20]

The recommendations for healthy media use needs updating, with development of age specific guidelines regarding the quantity and timing of electronic media.

1. Night time / Bedtime routine, maintaining a consistent sleep schedule
2. Keeping the sleeping environment cool, dark and quiet free from noise.
3. Avoid disruptors of sleep, such as light and screen time.
4. Stop screen devices about an hour before going to bed to give you time to relax and unwind.
5. Relaxation exercises such as, read a book, write a journal, or having a relaxing bath or shower. (Nothing too hot as it might wake you up again)
6. Less screen time, gives more time for socializing, family time, homework, sports, and extracurricular activities.
7. Talk to the teens about the internet safety and responsibilities of technology.

**CONCLUSION**

Mobile phone use prior to bedtime or even after lights-out is a common habit among many young adults. However, this unhealthy habit may lead to delayed bedtime, sleep loss, irregular sleep-wake patterns, poor sleep quality, and increased tiredness during the day. As technology usage continues to evolve, it is important for health professionals to understand its implications on health behaviors. The results of this review urge adolescents advocates like, Educational groups, government Organizations, policy makers, guardians, health care professionals, teachers and parents to develop mechanisms and measures that are made mandatory to reduce and prevent sleep deprivation in teenagers. The results of many studies also show that sleep disturbances are more prevalent among teenagers of all age groups. It is highly recommended and suggested by the researchers, that sleep deprivation can be prevented with special focus on lifestyle modification and increased parental supervision are effective strategies to prevent sleep deprivation.

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